

Memo

To: NPDES Permit Writers
From: Tom Atkinson
Date: November 20, 2008
Re: Deriving total nitrogen limits from the WLA in the Cedar River TMDL

A Total Maximum Daily Load (TMDL) has been prepared by the department and approved by EPA Region VII that addresses nitrate impairment of the Cedar River upstream of the Cedar Rapids Water Works. The approved TMDL specifies wasteload allocations for total nitrogen for point sources in the watershed. For controlled discharge lagoons the wasteload allocations are expressed as tons per year of total nitrogen that a source is allowed to discharge. The procedure developed on August 30, 2007 addresses how the department will implement this and future TMDLs and associated wasteload allocations that regulate the total nitrogen discharge on an annual basis from controlled discharge lagoons. For facilities that discharge on a continuous basis, the wasteload allocations are expressed as pounds per day of total nitrogen that a source is allowed to discharge. This procedure addresses how the department will implement this TMDL and the associated wasteload allocations for continuous discharge facilities.

The wasteload allocations in the Cedar River TMDL were set as the estimated current discharges, requiring no reductions from point source discharges. These estimates were calculated in one of four ways which resulted in average daily discharges from each facility. For most facilities the 2000 census population was multiplied by 0.027 lbs of TKN/ca/day, which is an accepted literature value for the amount of nitrogen contributed to domestic wastewater by each person. If organic industrial waste was present this was added to the estimate. A similar approach was used for estimating loads from controlled discharge lagoons, with the understanding that the discharge would not be continuous. Some facilities provided a limited amount of effluent data, which was averaged and set as the estimated daily load.

In light of the decision by the U.S. Court of Appeals for the D.C. Circuit in *Friends of the Earth, Inc. v. EPA, et al.*, the TMDL must specify the total maximum daily loads as "daily" loads. For this reason, the wasteload allocations in the Cedar River TMDL were set as daily loads. The EPA issued a memo on November 15, 2006 which discusses the implications the *Friends of the Earth* decision has on NPDES permits. This memo notes that the decision does not affect the NPDES permitting authority's ability to use all available tools to translate TMDLs and their wasteload allocations into enforceable effluent limitations in discharge permits.

Attachment #1 lists the Total Nitrogen limits, which were derived from the wasteload allocations listed in the Cedar River Nitrate TMDL using the following procedures and the data available as of the date of this memo.

The USEPA (1991) *Technical Support Document for Water Quality-Based Toxics Control* contains the statistical permit limit derivation procedure. The department utilizes a similar procedure, found in the *Supporting Document for Iowa Water Quality Management Plans*, to derive WQBELs. Due to the procedures used to calculate the wasteload allocations in the Cedar

River TMDL, the wasteload allocations shall be used as the long-term average (LTA) in the permit derivation procedure. Using the multipliers in the tables in Attachment #2 the maximum daily limit (MDL) and an average monthly limit (AML) can be calculated.

The multiplier used is dependent on factors such as effluent variability, number of samples collected per month, and the targeted percentile of occurrence probability. For this procedure, the LTA multipliers for both the MDL and AML calculations shall be based on the 99th percentile occurrence probability. The effluent variability is expressed as the coefficient of variability (CV). With the very limited amount of data that is available, the default CV of 0.6 shall be used until more data is available. At the time sufficient data (at least 10 data points) are available the CV can be calculated by dividing the standard deviation of the data by the average of the data. For purposes of determining the LTA multiplier for the AML, the number of samples per months shall be four unless more frequent sampling is required.

For example, the wasteload allocation in the TMDL for the City of Cedar Falls WWTP is 686 lbs/day. Using the default CV of 0.6 and four samples per month, the daily LTA multiplier is 3.11 and the monthly LTA multiplier is 1.9. Using this information, effluent limitations are calculated as follows:

$$\begin{aligned}\text{MDL} &= 686 \text{ lbs/day} * 3.11 = 2133 \text{ lbs/day} \\ \text{AML} &= 686 \text{ lbs/day} * 1.9 = 1303 \text{ lbs/day}\end{aligned}$$

Effluent limits that are calculated using this procedure are deemed to be consistent with the assumptions and requirements of the wasteload allocations in the TMDL.

NPDS

Monitoring requirements shall be added for total nitrogen as follows:

WW Parameter = NITROGEN, TOTAL; Monitoring Location = FINAL EFFLUENT; Sampling Frequency = 1 TIME PER WEEK; Sample Type = 24 HOUR COMPOSITE; Basis for Monitoring = BPJ; Limits Basis = WATER QUALITY STANDARDS/WLA; Season Indicator = Yearly; Concentration Units = MG/L; Mass Units = LBS/DAY. The following language shall be added as Special Monitoring: *Total Nitrogen is to be calculated as Total Kjeldahl Nitrogen (TKN) + Nitrate + Nitrite (as N). TKN and Nitrate + Nitrite (as N) testing must be conducted per the methods specified in 40 CFR 136.*

The limits calculated above shall be entered as 30 Day Average and Daily Maximum mass limits.

NOTE: For facilities with a population equivalent (P.E.) less than 501, the Sampling Frequency should be 1 EVERY MONTH.

ATTACHMENT #1

NPDES #	Facility	Continuous Discharge		
		WLA (tons Total Nitrogen/year)	TMDL WLA (lbs Total Nitrogen/day)	Average Monthly Limit (lbs TN/day) Maximum Daily Limit (lbs TN/day)
3414001	City of Floyd	1.8	9.7	18.4 30.2
0932001	City of Janesville	4.1	22.4	42.6 69.7
6673001	City of St. Ansgar	5.1	27.8	52.8 86.5
1967001	City of Nashua	8.2	45.1	85.7 140.3
0915001	City of Denver	8	43.9	83.4 136.5
6663001	City of Osage	23	125.9	239.2 391.5
3405001	City of Charles City	35.6	195	370.5 606.5
0990001	City of Waverly	45.5	249.1	473.3 774.7
9525001	City of Forest City	21.5	117.8	223.8 366.4
1253001	City of Greene	5.4	29.7	56.4 92.4
9545001	City of Lake Mills	14.8	80.9	153.7 251.6
1700100	Lehigh Cement	0.1	0.8	1.5 2.5
0700115	Magellan Pipe Co.	0	0	0.0 0.0
1750001	City of Mason City	89.8	492	934.8 1530.1
3423001	City of Nora Springs	7.5	41.4	78.7 128.8
9855001	City of Northwood	10.1	55.4	105.3 172.3
1286001	City of Shellrock	6.4	35	66.5 108.9
1700901	City of Willow Pointe	0.3	1.6	3.0 5.0
1203001	Allison	5.5	30.4	57.8 94.5
1716901	Clear Lake S.D.	1.5	8	15.2 24.9
3500901	DNR Beeds Lake S.P.	0.8	4.3	8.2 13.4
1240001	Dumont	3.3	18.3	34.8 56.9
3500201	Gold Key Dining & Lounge	0.2	0.9	1.7 2.8
3500202	Gold Key Motel	0.1	0.5	1.0 1.6
3544001	Hampton	16.2	89	169.1 276.8
3570001	Sheffield	4.6	25.1	47.7 78.1
4201001	Ackley	8.9	48.8	92.7 151.8
1207001	Aplington	5.2	28.5	54.2 88.6
1271001	New Hartford	3.2	17.8	33.8 55.4
3890001	Wellsburg	3.5	19.3	36.7 60.0
3815001	Dike	4.7	25.5	48.5 79.3
3833001	Grundy Center	2.2	12	22.8 37.3
0737002	Hudson	10.4	57.2	108.7 177.9
3870001	Reinbeck	8.6	47.3	89.9 147.1
3809001	City of Conrad	5.2	28.5	54.2 88.6
8640001	City of Gladbrook	5	27.4	52.1 85.2
0743001	City of La Porte	11.2	61.4	116.7 191.0
8681001	City of Traer	7.9	43	81.7 133.7
0603001	Atkins	4.8	26.4	50.2 82.1
0600201	Benton Commerce Village	0.5	3	5.7 9.3
1011001	Brandon	1.5	8.4	16.0 26.1
0709001	Cedar Falls	125.2	686	1303.4 2133.5
3405001	Center Point North	6.8	37.1	70.5 115.4
5718002	Center Point South	3.1	17.1	32.5 53.2
0600601	Country Aire	0.1	0.8	1.5 2.5
0721001	Elk Run Heights	6.4	35.1	66.7 109.2
0723001	Evansdale	22.3	122.2	232.2 380.0
0733001	Gilbertville	3.8	20.7	39.3 64.4
5700104	IP&L Duane Arnold	0.5	2.6	4.9 8.1
1044002	Jesup South	1.3	7.3	13.9 22.7
1044001	Jesup Southeast	9.6	52.5	99.8 163.3
0653001	Newhall	4.4	23.9	45.4 74.3
5765001	Palo	3	16.6	31.5 51.6
0670001	Shellsburg	4.6	25.3	48.1 78.7
0600600	Timber Ridge MHP	0.7	3.8	7.2 11.8
0680001	Urbana	5	27.5	52.3 85.5
0688001	Vinton	20.3	111	210.9 345.2
0790001	Waterloo	505.2	2768	5259.2 8608.5

ATTACHMENT #2

Daily LTA Multiplier

Maximum Daily Limit (MDL)

$$MDL = LTA \cdot e^{[z\sigma - 0.5\sigma^2]}$$

where: $\sigma^2 = \ln[CV^2 + 1]$

$z = 1.645$ for 95th percentile
occurrence probability, and

$z = 2.326$ for 99th percentile
occurrence probability

CV	LTA multipliers	
	$e^{[z\sigma - 0.5\sigma^2]}$	
	95th percentile	99th percentile
0.1	1.17	1.25
0.2	1.36	1.55
0.3	1.55	1.90
0.4	1.75	2.27
0.5	1.95	2.68
0.6	2.13	3.11
0.7	2.31	3.56
0.8	2.48	4.01
0.9	2.64	4.46
1.0	2.78	4.98
1.1	2.91	5.34
1.2	3.03	5.76
1.3	3.13	6.17
1.4	3.23	6.56
1.5	3.31	6.93
1.6	3.38	7.29
1.7	3.45	7.63
1.8	3.51	7.95
1.9	3.56	8.26
2.0	3.60	8.55



Monthly LTA Multiplier

Average Monthly Limit (AML)

$$\text{AML} = \text{LTA} \cdot e^{[z\sigma_n - 0.5\sigma_n^2]}$$

where: $\sigma_n^2 = 1/n[\text{CV}^2/n + 1]$.

$z = 1.645$ for 95th percentile
occurrence probability, and

$z = 2.326$ for 99th percentile
occurrence probability

n = number of samples/month

cv	LTA multipliers									
	$e^{[z\sigma_n - 0.5\sigma_n^2]}$									
	95th percentile					99th percentile				
	n=1	n=2	n=4	n=8	n=30	n=1	n=2	n=4	n=10	n=30
0.1	1.17	1.12	1.08	1.06	1.03	1.25	1.18	1.12	1.08	1.04
0.2	1.36	1.25	1.17	1.12	1.06	1.56	1.37	1.25	1.16	1.08
0.3	1.55	1.38	1.26	1.18	1.09	1.90	1.59	1.40	1.24	1.13
0.4	1.75	1.52	1.36	1.25	1.12	2.27	1.83	1.55	1.33	1.18
0.5	1.96	1.66	1.45	1.31	1.16	2.68	2.09	1.72	1.42	1.23
0.6	2.13	1.80	1.55	1.38	1.19	3.11	2.37	1.90	1.52	1.28
0.7	2.31	1.94	1.65	1.45	1.22	3.56	2.66	2.08	1.62	1.33
0.8	2.48	2.07	1.75	1.52	1.26	4.01	2.96	2.27	1.73	1.39
0.9	2.64	2.20	1.85	1.59	1.29	4.46	3.28	2.48	1.84	1.44
1.0	2.78	2.33	1.95	1.66	1.33	4.90	3.59	2.68	1.96	1.50
1.1	2.91	2.45	2.04	1.73	1.36	5.34	3.91	2.90	2.07	1.56
1.2	3.03	2.56	2.13	1.80	1.39	5.76	4.23	3.11	2.19	1.62
1.3	3.13	2.67	2.23	1.87	1.43	6.17	4.55	3.34	2.32	1.68
1.4	3.23	2.77	2.31	1.94	1.47	6.56	4.86	3.55	2.45	1.74
1.5	3.31	2.86	2.40	2.00	1.50	6.93	5.17	3.78	2.58	1.80
1.6	3.38	2.95	2.48	2.07	1.54	7.29	5.47	4.01	2.71	1.87
1.7	3.45	3.03	2.56	2.14	1.57	7.63	5.77	4.23	2.84	1.93
1.8	3.51	3.10	2.64	2.20	1.61	7.96	6.06	4.45	2.98	2.00
1.9	3.56	3.17	2.71	2.27	1.64	8.26	6.34	4.68	3.12	2.07
2.0	3.60	3.23	2.78	2.33	1.68	8.55	6.61	4.90	3.26	2.14

